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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D. C. 20554

In the Matter of	)	
	)	GEN Docket No. 90-314
Amendment of the Commission's	)	ET Docket No. 92-100
Rules to Establish New Personal	)	
Communications Services	)	

To: The Commission

Reply Comments of Apple Computer, Inc.

Apple Computer, Inc. ("Apple") hereby submits reply comments on the Notice of Proposed Rulemaking and Tentative Decision ("NPRM") in the above-referenced proceeding.

Apple strongly supports the Commission's efforts to foster un-licensed PCS technologies, including Data-PCS , which was the subject of Apple's January, 1991 Petition for Rulemaking.[1] As stated in its initial comments, however, Apple has serious concerns about the insufficiency of the frequencies proposed for unlicensed operation and the Commission's lack of rigor in clearing microwave users from the 2 GHz band.

Apple stated in its original Petition,[2] and believes now even more strongly, that 40 MHz is the minimum spectrum required for unlicensed, data-only communications applications. Still more frequencies are needed for the additional telephony applications (wireless PBXs and cordless telephones) the Commission has proposed it include in the unlicensed PCS band. Yet, the Commission has proposed only 20 MHz in total for all these applications.

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1 Apple's Petition for Rulemaking, RM 7618 ("Apple Petition") now has been consolidated in the instant proceeding, Gen. Docket. 90-314 .

2 Apple Petition at 21.

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List A B C D E

I. Additional Spectrum Must Be Allocated To Support Anticipated Unlicensed PCS Applications.

The record in this proceeding reveals two salient points regarding the amount of spectrum required to support unlicensed PCS technologies:

- The rich diversity of all the applications that manufacturers and users are planning today for the unlicensed frequencies requires far in excess of 20 MHz. Moreover, the Commission's goals of encouraging the introduction of still newer technologies cannot even be contemplated with so few frequencies.

- For a variety of reasons, the unlicensed PCS band will become home to many carrier-type PCS applications, as the licensing process is delayed and as many applicants are turned away empty-handed. If even a modest portion of the asserted market demand for carrier-PCS migrates to the unlicensed band, spectrum congestion will render a 20 MHz band unusable .

If the unlicensed PCS band is to fulfill the promise that both the Commission and its early proponents foresaw for it, the Commission must take two essential actions:

- Allocate at least 40 to 65 MHz to unlicensed PCS technologies; and

- Require conformance to an effective channel access and usage etiquette, to preclude a single PCS application from completely consuming the unlicensed frequencies.

A. At Least 40 To 65 MHz Is Needed For Data-PCS And User-PCS.

Apple, as a participant in WINForum and the IEEE 802 Local Area Network Standards Committee, supports and will not repeat the showing of need for additional frequencies that those organizations have made.

Many other parties have stated that substantially more spectrum is needed. These include AT&T, Andrew Corporation, California Microwave, Ericsson, Hewlett-Packard, Hitachi Telecom (USA), Interdigital

Communications, Knowledge Implementations, Northern Telecom, Pacific Communication Sciences, Pacific Telesis, Rolm, Rose Communications, the South Carolina Telephone Association, Xircom, Teknekron Communications Systems, and the U.S. Telephone Association.

B. The Unlicensed Band Will Be Widely Used For Purposes Other Than Data-PCS and User-PCS.

The comments in this proceeding reveal a development that was not anticipated by the Commission when it issued the NPRM. That is, the unlicensed PCS band will be widely used by many carrier-type PCS applications, as the licensing process is delayed, as many applicants are turned away empty-handed, and as new spectrum-dependent technologies and services are developed, which cannot be accommodated by the then-existing PCS licensees.

For example, some local exchange carriers have strongly supported the Commission's proposal for a 10 MHz set-aside to provide for their wireless "tails." These showings of need for such an application suggest that, if such a set-aside is not made, unlicensed frequencies could well serve as a substitute.[3] Others with substantial infrastructures in place, such as cable television providers, also will turn to the unlicensed band as the only viable alternative if denied PCS licenses.[4]

Other parties have described PCS applications that most likely would fit within the proposed eligibility qualifications for the unlicensed PCS band, although such applications were not contemplated in the original formulation of Data-PCS or other User-PCS uses by proponents of the unlicensed bands.[5] Still

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3 See, e.g., Comments of BellSouth at 23 ("[t]his allocation [of 10 MHz for local loops] would allow advanced radio technology to be used by a provider of local telecommunications service, such as an LEC or a competitive access provider, in order to connect end users to the provider's network by wireless, instead of wired, means. . . . Any provider of local loop service, such as LECs, competitive access providers, or cable television companies, should be eligible to apply for that license in order to integrate advanced radio technology into local loops. ").

4 See, e.g., Comments of the United States Small Business Administration at 6 n. 4, 7 ("[a] number of experimental licenses have been issued for test of PCN. The majority have been issued to cable companies because their ubiquity and the carrying capacity of their coaxial cables provide excellent base points for microcells."; "Some analysts expect PCS to permit the development of wireless private branch exchanges (PBXs) and allow for a wireless local loop between the central office of the local exchange carrier (LEC) and a telephone customer.").

5 See, e.g., Comments of Centel Corp. at 7, 13-14 ("[a]mong other things, the company views PCS as an opportunity to expand its offerings through new in-building services, lower cost

other parties forthrightly acknowledge some of the roles the unlicensed band could play in deploying PCS that otherwise would be licensed.[6]

Some companies that share Apple's concerns about congestion in the unlicensed PCS band have advocated regulatory limits on such use of the unlicensed frequencies.[7] Apple, however, does not believe that there can be effective application-defined regulatory barriers to unlicensed frequencies, even if such barriers were determined to be in the public interest.[8]

Rather, Apple believes that the Commission must respond directly to the need for unlicensed spectrum by increasing substantially the amount of 2 GHz frequencies allocated for unlicensed PCS.

II. The Demonstrated Need For Additional Frequencies In The Unlicensed PCS Band Increases The Difficulty, As Well As The Urgency, Of Clearing That Band Of Existing Microwave Users.

The record in this proceeding confirms Apple's long-standing position that there is no realistic way unlicensed PCS devices can share frequencies with the fixed microwave services. It is unnecessary to burden the record with

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wireless services with more limited functionality, and specialized targeted offerings. . . . [C]ertain PCS services would be particularly suited to a Part 15 type licensing scheme. Among these are the many types of in-building uses that have been proposed, such as wireless PBXs and wireless LANs.").

6 United States Telephone Association (USTA), whose "membership provides over 98 percent of the local telephone company-provided access lines in the U. S.," " supports the Commission's tentative decision to allocate spectrum for unlicensed PCS," and asserts that "[l]icensed providers may be able to utilize this spectrum if they are delayed in providing service due to the presence of an incumbent microwave user." Coments of United States Telephone Association at 1, 31. See also Coments of Corporate Technology Partners at 9 (there is one issue that the Commission does not seem to directly address regarding the proposed unlicensed PCS band, the ability of licensed operators to use this band. . . . CTP feels the FCC should make it clear licensed operators can also access the unlicensed band.").

7 For example, Advanced Cordless Technologies, Inc. "support[s] total exclusion of cellular carriers from the 2 GHz range, including the Part 15 segment. It is important that Part 15 be added to the exclusion, since it could be used to subvert the intent." Comments of Advanced Cordless Technologies, Inc. at 7.

8 Further, it is not now clear that anything other than universal access would best serve the public interest, given adequate spectrum and adequate rules for using it. From the viewpoint of computer users, there is virtually no limit to the panoply of valuable means of achieving connectivity with information resources, to peripheral devices, and among peers who are working, researching, or learning through the exchange of data. As Apple's Data-PCS Petition stated, means of developing, diversifying, and enhancing such connectivity options should not be impaired.

repetition of the many substantive statements, from virtually every company and interest group on all sides of this proceeding, to that effect.

Despite the FCC's effort to select the most lightly loaded microwave frequencies for unlicensed PCS operations — implicitly acknowledging the fact that there can be no sharing — a great many more microwave licensees will have to be relocated to accommodate the need for a substantial increase in the unlicensed PCS allocation.[9]

As Apple pointed out in its initial comments, there is a way to make a substantial contribution to this relocation task, at minimum disruption to microwave operators and minimum expense to those who will be required to reimburse the microwave licensees' reasonable relocation expenses. This relocation methodology involves movement within the 2 GHz band to achieve more efficient use of microwave frequencies while, at the same time, making room for important new PCS technologies.

The first priority for application of this methodology should be the 1910-1930 MHz band, correctly identified by the Commission as most favorable for clearing. At the time clearing of this band is accomplished nationwide, unlicensed devices can be deployed without risk of interference to microwave users. The remainder of an expanded unlicensed PCS band, comprising some additional 20 to 35 MHz, should be identified and reserved for unlicensed PCS applications while clearing is taking place.[10]

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9 Indeed, the task of clearing even these "lightly loaded" 20 MHz will be more difficult than anticipated by the Commission. The Commission apparently believes that the 430-some present microwave users at 1910-1930 MHz occupy single, unpaired paths. In reality, Apple's analysis shows that all but a very small number, less than a dozen, do not have a paired channel somewhere in the band or in another band. While the number of these links affords the best possible opportunity for clearing, the task is virtually double that which the Commission contemplated initially.

10 The Commission should also adopt an interim mechanism to provide limited developmental authority, perhaps under Part 5 of the Commission's Rules, for operation of certain classes of User-PCS applications, in the reserve band, that ultimately could become unlicensed when the full unlicensed band is completely cleared. Such applications could include wireless PBXs and wireless LANs that can be operated solely at a particular site far from fixed microwave receivers, under control of identified responsible parties, and only upon demonstration that mechanisms are in place to prevent any transmissions by any associated device at any other location.

III. An Adequate Allocation Of Frequencies For Unlicensed PCS Is Dependent Upon Adoption Of A State Of The Art PCS Frequency Plan And An Emphasis Upon Clearing PCS Spectrum Of Microwave Uses.

Allocation of additional frequencies for unlicensed PCS is jeopardized by two factors that the initial comments in this proceeding have made clear: one involves the Commission's proposed frequency plan for the PCS spectrum and the other factor results from the Commission's not giving sufficient priority to clearing existing microwave users from the 2 GHz band.

A. Defects In The Commission's Proposed Frequency Plan Will Make It More Difficult To Allocate Additional Frequencies To The Unlicensed Band.

The frequency assignment plan proposed for PCS will make it more difficult to allocate a sufficient number of frequencies to the unlicensed PCS band. As discussed below, the Commission's proposed frequency plan does not adequately reflect prevailing technology trends or the need to promote interoperability between licensed and unlicensed PCS devices and does not adequately consider the international ramifications of the PCS frequency plan.

The FCC's proposed frequency plan appears to assume that licensed PCS will be provided in the same manner that it assumes that present fixed microwave services are provided: frequency division duplexing ("FDD") wherein duplex operation is accomplished by separating transmit and receive channels by some 80 MHz. In other words, FDD is assumed to be the prevailing technology and the proposed PCS frequency plan matches it in order to ease the co-primary sharing of frequencies between microwave and PCS users, until the 2 GHz band can be cleared.[11]

This assumption ignores the fact that a very high proportion of all of the PCS experiments taking place in the U.S. pursuant to Part 5 authorizations and

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11 In fact, the proposed frequency plan does not adequately reflect present-day microwave frequency usage. In major areas of the country there seem to be more exceptions (by waiver) than there are adherents to the required 80 MHz pairing. This means that the process of negotiation between PCS proponents and microwave licensees will have to contend with the fact that clearing one path does not automatically clear another path 80 MHz removed for the same licensee. In practice, there will be overlaps among negotiating parties.

virtually all the PCS-type services being implemented and planned for elsewhere in the world are using time division duplexing ("TDD") techniques. TDD schemes do not require large disjoint bands of spectrum for transmit-receive pairing; instead, they use the same channel for both paths on a time-sharing basis.

Examples of such systems abound. PCS systems deployed in France, Germany, Netherlands, Finland, UK, Hong Kong and Singapore all employ one version or the other of TDD, most in a "CT2" embodiment.[12] In December Canada adopted a nationwide TDD standard for PCS. The Digital European Cordless Telecommunications standard adopted by CEPT, is a TDD standard. At least as importantly, Japan recently adopted a TDD standard for its Personal Handy Phone.[13]

While Apple does not believe that the FCC should dictate a TDD standard for PCS, the Commission should not actively discourage its use. Unfortunately,, the Commission has done so by proposing a frequency plan that encourages use of rigid 80 MHz-FDD.[14] This plan is wasteful of the spectrum available for allocation to the new PCS technologies, makes it more difficult to allocate additional spectrum for unlicensed PCS uses, obstructs interoperability between licensed and unlicensed PCS devices, and discourages international compatibility among PCS systems.

B. By Not Giving Sufficient Priority To Clearing Existing Microwave Users From The 2 GHz Band, Early Deployment Of Licensed PCS Will Force Licensees To Make Inefficient Use Of The Spectrum .

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12 See Cordless Personal Communications, Dr. Walter H.W. Tuttlebee, IEEE Communication Magazine, December, 1992, pp. 43-53 for a comprehensive survey article.

13 The Comments of Pacific Communications Sciences, Inc. ("PCSI") in this NPRM provide a particularly comprehensive discussion of all of the implications of various aspects of TDD. PCSI is successfully developing TDD circuitry in the U.S. and planning to export it.

14 There is an apparent anomoly in the way the Commission views unlicensed PCS in this regard. The intended single, contiguous narrow allocation for the unlicensed band makes TDD the most realistic technology for the unlicensed band, as wide frequency separation is simply not possible. While most computer data networks are not encumbered by this, and many cordless telephone and PBX implementations can operate in this environment, it is obvious that interoperability between a FDD PCS device and a TDD unlicensed device presents unfortunate challenges. If the Commission intends to support the potential of single-device versatility, the present scheme is singularly deficient.

For a variety of reasons, the Commission has not given sufficient emphasis to the need to clear existing microwave users from the 2 GHz band in order to make room for new PCS technologies. The long lead times and the complex negotiation and reimbursement process that the FCC has proposed have led to proposals for early deployment of licensed PCS that depend on spectrum sharing, or interference avoidance, techniques that virtually require inefficient use of the available PCS spectrum.

It is axiomatic that there can be a greater and more efficient "throughput" of PCS service, whether licensed or unlicensed, on cleared, exclusive frequencies than on frequencies that must be shared with fixed microwave facilities that are highly susceptible to interference.

A preponderance of the comments by the licensed PCS interests has confirmed that, in order for avoidance schemes to work effectively, there must be a substantial "playing field" in which to apply them. Rather than licensing a PCS carrier to 10 or 20 MHz , the Commission would have to license each PCS carrier to 40 MHz or more in order for them to co-exist with microwave users until the band can be cleared for exclusive PCS use. The obvious result is that there will not be enough spectrum for more than one or two PCS carriers and that the Commission will be unable to allocate adequate spectrum resources for unlicensed PCS.

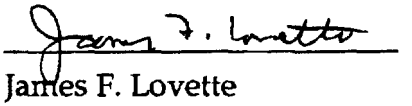
Instead of, in effect, encouraging the inefficient use of the PCS spectrum, in this manner, the Commission should focus its efforts on creating an effective means for clearing frequencies so that the full range of frequencies assigned to a PCS licensee can be employed.

CONCLUSION

For the reasons stated above, the Commission should move quickly to allocate additional frequencies for unlicensed PCS applications and to adopt a PCS frequency plan that encourages use of state of the art technologies, which can interact with each other and be compatible with PCS systems worldwide. In addition, the Commission should vigorously pursue a two-step process to clear the 2 GHz emerging technology frequencies of existing microwave operations; with the first step being to clear frequencies quickly for both unlicensed and

Respectfully submitted,

Apple Computer, Inc.



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